Douglas E. Booth

ROUTLEDGE

Advances in Social Economics

The Environmental Consequences of Growth

STEADY-STATE ECONOMICS AS AN ALTERNATIVE TO ECOLOGICAL DECLINE

THE ENVIRONMENTAL CONSEQUENCES OF GROWTH

The Environmental Consequences of Growth presents a new perspective on the link between economic growth and environmental change. New industries are necessary for economic growth but, far from offering a solution to our current environmental and ecological problems, they foster new problems. Even if some environmental problems can be resolved, others remain irreversible. Douglas E. Booth argues that a new ethical approach to evaluating environmental questions is urgently needed: we should give serious attention to the idea of steady-state economics.

The growth process envisioned in the book draws on the Schumpeterian concept of “creative destruction.” However, unlike some other authors, Douglas E. Booth has brought together historical data and case material from the United States and the United Kingdom which provide evidence that the economic growth process is indeed causing a cumulative expansion of environmental problems. The second half of the book provides an ethical framework based on the newly emergent field of environmental evaluation. The author demonstrates that policies based on steady-state economics can simultaneously satisfy human requirements for a decent life, and the moral commitment to preserve the global environment with its diverse life forms.

Written without technical language, this book is suitable for all readers; it assumes no previous understanding of economics. It will be invaluable to students of economics and ecological/environmental studies as well as to environmental policy makers.

Douglas E.Booth is Associate Professor of Economics at Marquette University in Milwaukee, Wisconsin. He is the author of *Valuing Nature: The Decline and Preservation of Old-Growth Forests* and *Regional Long Waves, Uneven Growth, and the Cooperative Alternatives,* as well as numerous articles.

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Published in conjunction with the Association of Social Economics.

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Steady-state economics as an alternative to ecological decline

Douglas E.Booth

London and New York

First published 1998 by Routledge 11 New Fetter Lane, London EC4P 4EE
This edition published in the Taylor & Francis e-Library, 2006.
"To purchase your own copy of this or any of Taylor & Francis or Routledge's collection of thousands of eBooks please go to http://www.ebookstore.tandf.co.uk/.

Simultaneously published in the USA and Canada by Routledge 29 West 35th Street, New York, NY 10001

British Library Cataloguing in Publication Data A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data Booth, Douglas E. The environmental consequences of growth: steady-state economics as an alternative to ecological decline/Douglas E.Booth p. cm.—(Advances in social economics) Includes bibliographical references and index. 1. Economic development—Environmental apects. 2. Economic development—Moral and ethical aspects. 3. Environmental degradation—Economic aspects. I. Title. II. Series. HD75.6B66 1998 363.7–dc21 97–13793 CIP

ISBN 0-203-01078-7 Master e-book ISBN

ISBN 0-203-17212-4 (Adobe eReader Format)
ISBN 0-415-16990-9 (hbk)
ISBN 0-415-16991-7 (pbk)

Dedicated to the memory of Ruth and Leonard Booth

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PREFACE

This book arose from my concerns that environmental problems are more deeply rooted and systematic than implied by the usual economics textbook analysis of market failure. The inference I have always drawn from the market failure approach is that with a patch here and a patch there the problem can be solved; underlying economic institutions are fundamentally sound and all that is needed is reform around the edges. My own thinking is contrary to this view and has been profoundly influenced by Herman Daly's work and, in particular, his notion that the scale of the global economy is growing relative to the scale of the global ecosystem, creating serious natural resource and environmental problems that are not easily resolved. While in the end I agree with Daly's call for a steady-state economy, my own approach is a little different than his. My goal here is to find the economic dynamic that drives environmental change. My own conclusion is that environmental change is the direct result of the processes that drive economic growth in modern capitalist economies. If I am right, then to resolve the problem of environmental decline—some would call it a crisis—requires fundamental changes in modern economic institutions.

My goal in writing this book is to also provide a work that is accessible to undergraduate students and lay readers who have had introductory economics. In my own classes I have used the material presented here to provide a counter-point to conventional environmental texts and to foster healthy and interesting debates on whether the modest reforms suggested in the usual texts are enough to resolve environmental problems or whether something deeper is needed. Through these discussions, my students have helped me immeasurably in honing my own thinking.

Finally, in writing this book I wanted undergraduates to have an opportunity to read a work that not only integrates economic and ecological thought, but also is explicitly value-oriented in its premises. This book is not value-free! It is based on the notion of a human duty to preserve the natural environment. Whether such a duty is appropriate or will ever be widely held, I leave to the reader to judge. My point is that it ought to be given serious consideration.

Not only have my students contributed to this work with their comments and insights, but so have a host of others, including a lengthy list of anonymous referees, Herman Daly, John Tomer, and John Davis. Of course, none of these individuals can be held responsible for any remaining errors in my ways. I am also grateful to Marquette University for the opportunity to work as a teacher-scholar and to undertake this book as a part of my normal duties.

1
INTRODUCTION
Economic growth and environmental change

After a quarter century of environmental regulation in the U.S. under the auspices of the Environmental Protection Agency and other governmental bodies, substantial environmental threats remain. Ambient standards for ozone and other air pollutants are frequently violated in urban areas; lakes and rivers continue to be heavily polluted; ambient levels of toxic chemicals in the biotic food chain are at high levels; little has been done about the potentially serious problem of greenhouse warming; and biodiversity is threatened as a consequence of reduced and fragmented natural habitats. A similar story can be told for other prosperous countries of the world such as Great Britain and its fellow members of the European Community. Why has the regulatory system in the U.S. and elsewhere failed to fully address environmental problems?

The goal of this book is to suggest that the roots of environmental change are deeply embedded in the processes that generate economic growth. The central proposition put forth and evaluated in the pages to follow is that forces leading to economic growth in market capitalist economies also lead to environmental change. Technological change, innovation, and the drive for wealth result in the creation of new high-growth industries required for macroeconomic expansion; these same high-growth industries foster environmental change and resist regulatory efforts to limit such change; consequently, economic forces essential to economic growth are responsible for environmental problems.

Because growth itself is the essence of the environmental problem, a new economic vision is needed, one that is rooted in a wider view of human values and ethics. The alternative vision offered here is a steady-state economy, one with the capacity not only to satisfy real human needs, but to preserve the global environment and its full diversity of forms of life. After an exploration of the causes of environmental change in the first six chapters of the book, the alternative vision and its ethical foundations are then addressed in the next five chapters.

Comparison to the conventional view of environmental issues

Because economic growth and growing environmental problems in the absence of effective regulation go hand-in-hand, the environmental problem in this book is seen as fundamentally macroeconomic in character. The conventional view of environmental problems is, to the contrary, fundamentally microeconomic. Environmental problems in the eyes of conventional economists exist because of a failure of the pricing system (Tietenberg 1994). Market-determined prices fail to fully reflect the social costs of environmental damage caused by economic activity, and the solution to the environmental problem is to "get the prices right." This is to be done by internalizing the social costs of environmental damage. Instead of allowing an electric power plant or a chemical plant to externalize environmental costs by emitting pollutants and imposing damage from environmental degradation on the larger society, they should be required to bear the costs of pollution control and environmental damage internally. As a result, prices of products would fully reflect the social costs of using environmental resources and such use would be efficient. While this approach is appealing, in a profit- and growth-oriented economy it is fundamentally problematic, as we will now see.

Economic growth as a cause of environmental decline

The microeconomic insight—that profit-oriented economic agents will have a strong propensity to externalize environmental costs—is indeed compelling. That the internalization of environmental costs would reduce environmental problems is undeniable. However, environmental costs in a profit-driven capitalist economy are typically not fully internalized. Why is this?

Conventional microeconomic thinking does not get at the essence of the cost internalization failure problem, an issue better addressed by considering the nature of the capitalist macroeconomic development process as described by Joseph Schumpeter (1939, 1950) and others. According to a Schumpeterian view, the creation of new industries based on new technologies is fundamental to macroeconomic growth. Growth is driven by qualitative change in the structure of the economy, qualitative changes that inevitably seem to lead to changes in the natural environment. New industries invariably seem to create new environmental problems by virtue of their inherent propensity to externalize environmental costs. Once such industries are created, they often form powerful vested interests that oppose environmental regulations and insure that environmental costs remain externalized to the greatest extent possible. Profit-maximizing electric utilities and chemical companies, for example, typically oppose pollution control regulations that increase their costs and reduce their profits. The consumers of the products of these industries also constitute potentially powerful vested interests not wanting to see their costs of consumption rise as a consequence of environmental regulations. The process of economic growth thus creates vested interests opposed to the internalization of environmental costs. The growth process has the potential to defeat the goal of cost internalization. Consequently, growth is in practice the fundamental issue, not prices. As long as growth in its existing form persists, powerful interest groups will work hard at avoiding environmental cost internalization. Simply put, the forces of economic growth oppose cost internalization.

Ethics and the evaluation of environmental change

Even if all environmental costs were successfully internalized, economic growth could still lead to environmental deterioration. This would occur if the added benefits of growth exceeded the added social costs of environmental damage resulting from growth. The added benefits of continuing to use fossil fuels may well exceed the added social costs of future global warming resulting from carbon dioxide emissions associated with fossil fuel use (Nordhaus 1991).[1] Nonetheless, global warming is likely to cause significant economic harm to future generations and result in the destruction of ecosystems and species (Cline 1992; Abrahamson 1989). Net economic welfare (taking full account of environmental costs to current and future generations) may well be maximized by continuing to use fossil fuels even though the consequences may be catastrophic for individual members of future generations and for species and ecosystems.

This conclusion results from an implicit acceptance of a utilitarian ethical framework underlying cost-benefit analysis, a framework that neglects the moral worth of human individuals in present and future generations, plant and animal species, and ecosystems. If our ethical framework is broadened to include the well being of human individuals, species, and ecosystems, then cost-benefit analysis and social cost internalization are inadequate criteria for determining acceptable levels of environmental damage. If human individuals, species, and ecosystems are viewed as having moral worth, then a dollar value cannot be meaningfully assigned to them in order to assess the extent of external social costs. For any given act of environmental destruction, there will be social costs that *can* be calculated, such as the damage to buildings or loss of crops from air pollution. However, there also may be moral costs that *cannot* be calculated. Most find the idea of assigning a dollar value to human life repugnant. Human individuals may be so poor that they have very little willingness to pay for a clean environment necessary for a full and healthy life. In such circumstances, many would find it morally reprehensible to advocate the continuation of health-damaging pollution even though added social benefits exceed added costs. This suggests that individual human lives are valuable in their own right, not just for the incomes they earn or the utility they deliver to others in society. The same can be said for species and ecosystems, beings that also may have value in their own right apart from any utility they deliver. If so, then assigning a dollar value to them would be repugnant as well.

The point is simple. Social costs are calculable in dollar terms; moral costs are not. Even if social costs are fully internalized, economic growth and environmental deterioration could result in “moral costs” avoidable only through the maintenance of a specified level of environmental quality that may limit economic growth. The moral costs associated with global warming, for example, may be avoidable only by halting or even reversing the global warming trend. This may be the case even though the added social costs of doing so exceed the added social benefits. A central thesis to be explored in the chapters to follow is that the internalization of both the social and moral costs of environmental change will be resisted by those whose interests are tied to unfettered growth, interests that are created by the economic growth process itself.

Sustainability and the steady state

Some argue that economic growth is necessary to provide resources to pay for environmental protection and reverse environmental deterioration (Grossman and Krueger 1993). Herman Daly (1991a) vigorously opposes this view, invoking the entropy principle. For Daly, production is inherently entropic, converting high-quality low-entropy matter and energy into high-entropy environmentally disruptive waste. If Daly is right, then as historically experienced, economic growth is contrary to any notion of sustainability. In its broadest conception, sustainability refers to preserving the ability to produce at existing levels. If our concerns extend beyond production to the protection of human individuals, species, and ecosystems for their own sake, then a more precise definition is needed.

The most concrete concept of sustainability is a steady-state economy. In a steady-state economy, natural resources are consumed at a fixed, sustainable rate and the quality of the environment is maintained at a level that protects the health of human individuals, species, and ecosystems (Daly 1991a). The global ecosystem's ability to provide material inputs to the global economy and to absorb its waste byproducts is inherently limited, and under a steady-state economy the demands placed upon the global ecosystem by the global economy are appropriately restrained. Daly's steady-state economics is really the precursor to modern conceptions of sustainable development calling for the passing on of a stock of natural capital to future generations at least equal to that enjoyed by the current generation (Pearce 1993:15–19). Some advocates of sustainable development call for a nondeclining total capital stock, mixing capital goods produced by humans and the natural capital stock. This approach is sometimes referred to as weak sustainability and assumes produced and natural capital are substitutes for one another. Daly's version of sustainability denies substitutability and argues for a strong version that passes on a nondeclining natural capital stock to future generations.

Nothing in conventional neoclassical environmental microeconomics suggests the concept of sustainability. If benefit-cost analysis argues for the destruction of a natural area, the extinction of a species, or the using up of a natural resource, so be it. An ethical approach, presuming that the well being of future generations is a matter of present concern, and that human individuals, species, and ecosystems have value in their own right, leads more directly to the concept of sustainability. A properly defined steady-state economy assures the provision of adequate natural resources for future generations and the protection of the health and well being of human individuals, species, and ecosystems.

A steady state does *not* necessarily imply zero economic growth. Economic growth can take place so long as the productivity of natural and environmental resources is increased through technological advance. Rather than labor productivity (output per unit labor) being the focus of attention, environmental resource productivity (output per unit resource) would take center stage in order for there to be significant economic growth. Economic growth would most likely be reduced relative to the historical experience in a steady state since in the past, environmental resource use faced few constraints.

The plan of the book

Each of these claims requires elaboration and justification. Chapters 2 to 5 address the central thesis of the book—new industries are required for long-term economic growth and cause environmental change. The justification for this thesis is necessarily empirical and historical. After the basic theory of the link between economic growth and environmental change has been set out in Chapter 2, historical evidence for the relationship is presented in Chapters 3, 4, and 5. The basic theoretical idea presented in Chapter 2 is the Schumpeterian notion that long-run economic growth proceeds through the addition of new forms of economic activity. If these new forms of economic activity bring forth new kinds of environmental problems, then the forces that lead to economic growth also lead to environmental change. The job of Chapter 3 is to present historical evidence that our existing array of environmental problems can be traced to the industry creation process underpinning economic growth. Chapters 4 and 5 demonstrate the significance of our environmental problems. The serious problem of natural habitat decline is addressed in Chapter 4 and the problems of air, water, and toxic pollution are considered in Chapter 5. To understand and evaluate the full consequences of economic growth for environmental change, we need to know the characteristics of key ecosystems and something about their functioning. Only in this way can we understand what is lost when ecosystems are destroyed or altered by economic growth. This knowledge is especially needed if an ethical framework is adopted where the moral considerability of ecosystems and species must be assessed. Knowledge of something necessarily precedes moral attachment to it, or even the recognition of the possibility of moral attachment. The goal of Chapters 4 and 5 is to give us a better understanding of what is lost exactly as a consequence of environmental change.

In Chapter 6 historical efforts at environmental regulation will be described and assessed. The basic conclusions are that vested economic interests have indeed limited the extent of regulation and that regulation has thus far failed to resolve key environmental problems.

Having established the link between economic growth and environmental change, in Chapter 7 the normative framework for evaluating the problem of environmental decline is presented. The utilitarian benefit-cost framework of conventional neoclassical derivation is rejected in favor of an approach founded on the principles of environmental ethics that sees human individuals, species, and ecosystems as valuable in their own right and thus priceless in the sense that their value is not representable in monetary terms.

Chapter 8 offers the steady-state approach as an alternative to conventional regulation and suggests how a steady state can be implemented. The steady state is justified not in terms of utilitarian benefit-cost analysis, but on the basis of the broader ethical framework suggested in Chapter 7. A steady-state approach is considered for air and water pollution problems, toxins, and natural habitat preservation.

A steady-state economy is a radical departure from a modern high-growth capitalist economy and will require rather different policies for macroeconomic management. This question is addressed in Chapter 9, along with the issue of whether capitalism is even compatible with a steady state. In Chapter 10, the democratically run producer cooperative is evaluated and found to be a more environmentally friendly form of business organization better suited to a steady-state economy than the capitalist corporation.

In the final chapter, the key themes of the book will be brought to bear on the difficult issue of moving from a high-growth to a steady-state economy. Highly developed western economies seem to be hooked on environmentally destructive growth, growth that is largely futile as a means to increase human happiness and expand the opportunity to live decent human lives. The foundation of growth seems to be a zero-sum game in which the participants seek higher incomes as a means to higher relative social status.

The problem is, growth can increase average incomes, but it is incapable of bringing forth increases in relative status. The question is, how do we in the prosperous countries of the world become unhooked from socially fruitless, environmentally destructive growth?

2
ECONOMIC GROWTH AND ENVIRONMENTAL CHANGE
Theory

The key points of this and the following three chapters of this book are simple. Technological change, innovation, and the drive for wealth accumulation lead to the creation of new high-growth industries required for macroeconomic growth; these high-growth industries foster environmental change; thus, the same forces that lead to economic growth are responsible for a changing natural environmental. The task here is to explore fully the logic of the economic growth/environment link and to provide historical evidence for it. The starting point is an investigation of the ties between the macroeconomy and the environment. For Herman Daly (1991a), as already noted in Chapter 1, production is inherently entropic, converting high-quality low-entropy matter and energy into high-entropy, environmentally disruptive waste. While Daly's position is compelling on theoretical grounds, to fully justify it requires a more specific conception of the relationship between economic growth and environmental change and more concrete historical and empirical support.

Economic circular flow and the environment

Anyone who has taken macroeconomics is familiar with circular flow analysis. Households purchase commodities produced by businesses, the expenditures of households become the revenues of businesses, and businesses use those revenues to purchase productive services (labor, capital, and natural resources) from households. The incomes of households in turn sustain expenditures on purchases from businesses. In the opposite direction, commodities and services flow from businesses to households and the factors of production flow from households to businesses. Commodities and money flow in an unending circle that never runs down, and, with continuous investment in additional productive capacity, the flow can be ever expanding.

This perception of the macroeconomy is misleading because it ignores scientific laws that place constraints on the flow of inputs into the economic system from the natural environment (Daly 1991a:195–210). The flow of energy and matter through the economic system is in reality linear and unidirectional, not circular. Energy and matter flow from the environment to the economic system and waste matter and heat flow from the economic system to the environment. The flow begins with the depletion of energy and material resources and ends with the pollution of the environment with waste matter and heat.

As Nicholas Georgescu-Roegen and Herman Daly have gone to great lengths to demonstrate (Georgescu-Roegen 1971, 1973; Daly 1991a), economists have failed in the construction of their macroeconomic models to recognize that the laws of thermodynamics dictate an absolute scarcity of energy and matter. It is this absolute scarcity that in turn negates the macroeconomic concept of circular flow.

The essence of the first law of thermodynamics is that energy and matter can be neither created nor destroyed. In other words, the stock of matter is fixed in availability, as is the maximum flow rate of energy. Thus there is an absolute scarcity of both. If energy and matter could be infinitely rearranged without loss, then this law would matter little for economic activity. The disordering of matter created by consumption could simply be compensated by the re-ordering of matter through production. Perpetual circular flow at a constant or even growing rate would indeed be possible. The problem is, whenever energy is used to re-order matter, something is permanently lost. This is explained by the second law of thermodynamics.

The second law of thermodynamics basically says that when used to perform work, energy is converted to a more dispersed, less useful form. To put it another way, whenever energy is used, some of it is given off in the form of waste heat. The entropy of energy increases. No energy-using process is 100 percent efficient. Entropy is the amount of energy in a system that is not available to do work in that system. An automobile burning petrol converts energy in a concentrated form into motion and waste heat. The automobile moves, but some of the energy is converted into waste heat unavailable for work.

The flow of matter in production and consumption is also an entropic process. Highly concentrated forms of matter are converted into useful artifacts in production, and in consumption those artifacts are converted into dispersed waste material. The energy of nature—sun, wind, rain, oxidation—causes materials to break down and become more dispersed. A house, for example, slowly deteriorates over time. The paint chips off, wood rots, and the roof deteriorates. An increase in entropy is a decrease in order. As the house deteriorates, its material contents become less ordered. To reconcentrate all dispersed matter from a consumption process would require an impossibly large amount of energy, rendering 100 percent recycling an impossibility. Matter, like energy, is subject to entropy.

The extent to which the entropy of energy and matter impinges on the circular flow of commodities in the macroeconomy or harms the human individuals and natural environments that frame the macroeconomy is a fundamental issue that must be addressed by an environmental approach to macroeconomics. The entropic linear flow of energy and matter results in changes to both biotic and abiotic components of what can be called the global ecosystem. Abiotic components include the earth's atmosphere and climatic patterns, the input of solar energy, and the reserves of energy and materials in the earth's crust. The biotic components include a vast array of species and biological communities created and shaped by the interaction of natural evolutionary forces and ecological processes, some of which have been further altered and reshaped by the human hand.

In short, the fundamental problem facing an environmental approach to macro-economics as an area of intellectual inquiry is this: the global economy is growing while the global ecosystem is stable in terms of its capacity to supply energy and materials, absorb wastes, and provide a host of ecosystem services (Daly 1991a: 180–194). As a result, stocks of nonrenewable resources in the earth's crust are being depleted, waste sinks are filling up, and human-created ecosystems (i.e. agriculture) are taking over a larger and larger percentage of global biotic productivity. Further consequences of these events include a plunge in global biotic diversity, the disappearance of natural habitats (such as tropical rain forests) and numerous environmental problems including global warming, air and water pollution, toxic wastes, and destruction of the protective ozone layer. To fully understand the impact of economic activity on ecosystems we need to know something of the services they provide. Then we will be able to move forward and consider the economy-environment relationship in detail.

Ecosystem services to human beings

Human beings are members of the biotic community and are thus dependent on the materials and services provided by ecosystems. We as biotic consumers need access to the primary productivity of plants, directly or indirectly. In the modern world this has been accomplished primarily through the creation of anthropogenic agricultural ecosystems that favor monocultures composed of species with high net primary productivity. Nonetheless, we do still rely on natural ecosystems for some food resources, such as fish and other marine organisms. Moreover, successful agriculture does rely indirectly on natural ecosystems. The most productive agricultural regions in the world are located on old grasslands with their legacies of extraordinarily rich soils, and the soils themselves constitute an essentially natural ecosystem, albeit one that is in danger of destruction from agricultural practices that cause erosion or the destruction of soil microorganisms. Moreover, the genetic stock of favored agricultural species has ancestral origins in natural ecosystems. This stock has been much modified through plant breeding, and the original ecosystems from which some of these plants were originally taken may no longer exist or may be threatened with extinction (Ehrlich *et al.* 1977).

In addition to foodstuffs, we extract a variety of fibers and chemicals from natural and anthropogenic ecosystems. For much of the last century, old-growth forests supplied most of the timber used in construction and served as the U.S.'s primary energy resource. Now that old-growth supplies are depleted, timber harvesting has shifted to second-growth plantation forests. Although many modern drugs have their origins in the flora and fauna of the tropical rain forests (Wilson 1988), other ecosystems are potential sources as well, as demonstrated by the recent discovery of taxol, a cancer-fighting chemical, in the Pacific yew, an understory species in Pacific Northwest old-growth forests (Booth 1994). In sum, ecosystems, both natural and anthropogenic, are essential sources of food, fiber, and chemicals for human use, actual as well as potential.

Ecosystems perform a variety of additional functions beneficial to human beings. Wetlands, for example, not only serve as nurseries and habitat for a variety of species, but also purify water and reduce the intensity of floods. Forests, like wetlands, are beneficial because they limit the rapidity of storm water runoff and the erosion that goes with it by storing moisture in their canopies and soils. Old-growth forests often contain the type of streams that are ideal habitat for certain fishes of great benefit to those who fish recreationally and commercially, such as salmon and trout. Forests also store up carbon